

## Chapter 8 Channel Protection

### 8-1. General

Stabilization of banks and protection of the stream bed will usually be required for the channel at the dam site. In addition, channel realignment and/or training structures may be required. The specific types of channel protection and stabilization will depend on water velocities, wash from waves, water level fluctuations, soil characteristics, stream alignment, sediment transport, wind velocities, and navigation approach conditions. This chapter will outline, in general terms, the overall requirements for channel protection. More details and guidance are contained in EM 1110-2-1611.

### 8-2. Erodible Slopes and Stream Bed

*a. Erodible slopes.* When geotechnical investigations and studies indicate that the stream banks at the dam site will not be stable under project operating conditions, it will be necessary to protect and stabilize these slopes so that they will not erode and displace into the stream or fail internally.

*b. Stream bed.* The stream bed immediately upstream and downstream of a concrete dam will require protection to prevent displacement of bed material that could undermine the structures and result in failure of the dam and/or appurtenant structures.

*c. Scour protection during construction.* Each construction scheme must be carefully analyzed to ensure that scour protection is provided where necessary. Successful protection has consisted of timber (lumber) mattresses or riprap, both with and without filter blankets, depending on the soil types and flow conditions. Physical and numerical models have been useful in developing scour protection designs. For cofferdams within the river channel, the riverward corner of the cofferdam is usually the critical point of scour potential. Wing extensions are sometimes provided to minimize the scour potential.

### 8-3. Typical Materials

*a. Slope protection materials.* For channel slope protection, the following materials are used most often: riprap stone placed on either a sand-and-gravel filter blanket or a filter cloth, soil-cement paving, concrete paving, steel pile cells filled with stone, and articulated concrete mattresses. To be effective, the slope protection system

material must be sized with a designed thickness and must be provided with drainage blankets or pipes so that water can pass through the protection without displacing the underlying support material. In most cases, the type of material chosen for slope protection will depend on the availability of suitable natural material in the project area, which is likely to be least costly.

*b. Streambed protection materials.* For streambed protection, the following materials are used: graded stone, derrick stone, concrete paving, trench-filled (stone) revetment, and lumber mattress. The materials chosen for streambed protection will depend on their availability and on specific design and maintenance requirements during the life of the project.

### 8-4. Dikes

Dikes for bank protection and stabilization can consist of stone, timber pile clusters, or piling with stone fill. These dikes are designed to divert currents away from the bank or improve the alignment and velocity of the currents along the bank. Training dikes can be very beneficial in controlling sediment deposition in the upstream and downstream lock approaches and in diverting spillway discharges away from the lower lock approach. See Plate 7. Wing dikes (also referred to as wing dams or spur dikes) placed approximately normal to the channel or lock approach have proven to be suitable for these purposes. Various types of dikes are described in EM 1110-2-1611.

### 8-5. Upstream Channel

*a. Channel slopes.* Just as the bank slope must be designed for stability, so the slope surfaces must be protected. Stone riprap on a sand-and-gravel blanket or on filter cloth can be used. Other forms of slope protection, such as articulated concrete mats, concrete paving, and soil-cement blankets, have also been used. The type of protection material chosen will depend on economy of usage and the ability of the material to satisfy design requirements for the life of the project with minimum maintenance costs.

*b. Streambed.* A low-head navigation dam will usually require streambed protection upstream of the spillway for a minimum distance equal to the head on the spillway crest. The protection is usually stone; however, concrete aprons have been used. Refer to EM 1110-2-1605 for details. High-head dams will not usually require upstream streambed protection because of the height of the spillway crest above the streambed. The upstream

streambed of a navigation dam with a ported upper guide wall adjacent to the dam spillway will require stone protection at the ported openings to prevent scour of the bed material due to water velocities caused by spillway discharges. This bed protection is especially important for soil-supported, pile-supported, or caisson-supported guide walls. Refer to Plates 3, 5, and 17.

#### **8-6. Downstream Channel**

*a. Channel slopes.* Treatment and protection of downstream channel slopes will be similar to that for upstream channel slopes. However, the thicknesses and the extent of this protection will usually be determined by using the results of the hydraulic model test. Refer to Plates 3 and 5 for more details.

*b. Design conditions for streambed downstream of gated spillway.* The streambed area immediately

downstream of the stilling basin will require a special hydraulic investigation to determine the amount and extent of streambed scour protection needed to counteract the forces created by the spillway discharges. The spillway gate operation design conditions are outlined in ER 1110-2-1458. For a streambed composed of sound rock, no protection may be needed. However, for a readily erodible streambed, several extensive layers of graded rock may be required. Gradation layers, size of stones, and extent of protection are usually designed by hydraulic engineers using guidance contained in EM 1110-2-1605. EM 1110-2-1605 covers scour protection experiences at existing Corps projects and repair recommendations for these projects. EM 1110-2-1601 and EM 1110-2-1901 contain further design information relative to riprap and filter designs.